CLAIMS

I claim:

1. An electrolyte system comprising:

a non-aqueous electrolyte solution including a non-aqueous solvent and a salt; and

a flame retardant material that is a liquid at room temperature and pressure and substantially immiscible in the non-aqueous electrolyte solution.

2. The electrolyte system according to claim 1, wherein the salt is present in the non-aqueous electrolyte solution in a concentration ranging from about 0.1 to about 3.0 moles/liter.

3. The electrolyte system according to claim 1, wherein the salt is present in the non-aqueous electrolyte solution in a concentration ranging from about 0.5 to about 2.0 moles/liter.

4. The electrolyte system according to claim 1, wherein the flame retardant material is a halogen-containing compound.

5. The electrolyte system according to claim 4, wherein the halogen-containing compound is present in an amount ranging from about 1 to about 99% by weight of the non-aqueous solvent.

6. The electrolyte system according to claim 4, wherein the halogen-containing compound is present in an amount ranging from about 1 to about 70% by weight of the non-aqueous solvent.

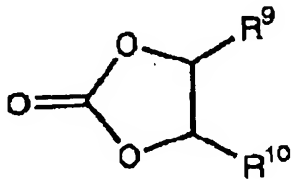
7. The electrolyte system according to claim 4, wherein the halogen-containing compound is present in an amount ranging from about 10 to about 60% by weight of the non-aqueous solvent.

8. The electrolyte system according to claim 4, wherein the halogen-containing compound is present in an amount ranging from about 20 to about 40% by weight of the non-aqueous solvent.

9. The electrolyte system of claim 1, wherein the non-aqueous solvent includes at least one carbonate selected from the group consisting of cyclic carbonates, linear carbonates and mixtures thereof.

10. The electrolyte system of claim 9, wherein the cyclic carbonate contains an alkylene group with 2 to 5 carbon atoms and the linear carbonate contains a hydrocarbon group with 1 to 5 carbon atoms.

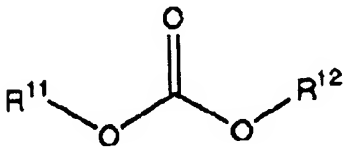
11. The electrolyte system according to claim 1, wherein the non-aqueous solvent includes at least one cyclic carbonate represented by the formula



[3]

wherein R^9 and R^{10} are independently selected from the group consisting of hydrogen, linear alkyl groups, branched alkyl groups, cyclic alkyl groups, and halogen-substituted alkyl groups in which at least one hydrogen is substituted by chlorine or bromine.

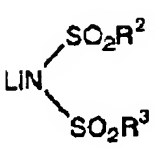
12. The electrolyte system according to claim 1, wherein the non-aqueous solvent includes at least one linear carbonate represented by the formula

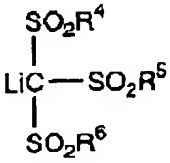


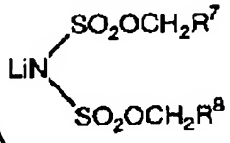
[4]

wherein R^{11} and R^{12} are independently selected from the group consisting of linear alkyl groups, branched alkyl groups, cyclic alkyl groups, and halogen-substituted alkyl groups in which at least one hydrogen atom is substituted by fluorine, chlorine or bromine.

13. The electrolyte system according to claim 1, wherein the salt is selected from the group consisting of $LiPF_6$, $LiBF_4$, $LiOSO_2R^1$,







wherein R^1 through R^8 are independently selected from the group consisting of perfluoroalkyls, alkyls or aryls with 1 to 6 carbon atoms.

14. The electrolyte system according to claim 4, wherein the halogen-containing compound contains at least one member selected from the group consisting of branched or unbranched alkyl, cyclic alkyl, ether, aminoalkyl, and aliphatic heterocyclic compound groups in which one or more hydrogen atoms are substituted by a halogen selected from the group consisting of fluorine, chlorine and bromine.

15. The electrolyte system according to claim 4, wherein the halogen-containing compound contains at least one member selected from the group consisting of perfluoroalkyl groups, perfluoroaminoalkyl groups, perfluoroether groups and mixtures thereof.

16. The electrolyte system according to claim 4, wherein the halogen-containing compound is perfluoro-1,3-dimethylcyclohexane.

17. A method of making an energy storage device comprising:

providing an electrode assembly including:

a first electrode member;

a second electrode member; and

a separator member physically and electrically separating the first electrode member from the second electrode member but capable of allowing ionic conductivity between the first electrode member and the second electrode member;

placing the assembly in a casing; and

filling the casing with the electrolyte system according to any of claims 1 to 15 by first, filling the casing at least partially with the non-aqueous electrolyte solution, waiting a period of time sufficient for the non-aqueous electrolyte solution to penetrate one or more pores of the electrode assembly, and then adding the flame retardant material to the casing.

18. The method of making an energy storage device of claim 17, further comprising the steps of charging energy storage device after adding the non-aqueous electrolyte solution.

19. A method of making an energy storage device according to claim 17, wherein the first electrode member is a negative electrode, the second electrode member is a positive electrode, and the separator member is a resin containing a polymer.

20. An energy storage device comprising:

the electrolyte system according to any of claims 1 to 15;

an electrode assembly, the electrode assembly including,

a first electrode member;

a second electrode member; and

a separator member physically and electrically separating the first electrode member from the second electrode member but capable of allowing ionic conductivity between the first electrode member and the second electrode member through the non-aqueous electrolyte solution; and

a casing enclosing the electrode assembly and the electrolyte system.

21. The energy storage device according to claim 20, wherein:

the first electrode member is a negative electrode containing a material selected from the group consisting of lithium metal, a lithium alloy, a carbon material that can be doped and undoped with lithium ions, a metal oxide that can

be doped and undoped with lithium ions, and silicon that can be doped and undoped with lithium ions,

the second electrode member is a positive electrode containing a material selected from the group consisting of complex oxide of lithium and a transition metal, and a complex oxide of lithium, transition metal and a non-transition metal, and

the separator member is a resin containing a polymer.

22. The energy storage device according to claim 21, wherein the metal oxide is selected from the group consisting of tin oxide and titanium oxide.

23. The energy storage device according to claim 21, wherein the energy storage device is a lithium battery.